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Cognitive and Cognitive-Communication Impairments of Patients with COVID-19: A Retrospective Study

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Abstract

Background: This study's objective is to characterize the cognitive and/or cognitive-communication impairments of COVID-19 patients identified by the Acquired Brain Injury (ABI) rehabilitation team located in Toronto, Canada during the early stages of the COVID-19 pandemic.

Methods: 33 Retrospective chart audits were completed using electronic medical records (EMR) for patients admitted to the COVID-19 cohort rehabilitation unit from April 2020 to June 2020. A chart audit tool was developed and used to standardize the collection of specific and relevant data elements to be included in the study.

Results: 58% of the entire sample was male, and on average 4 years older than the females. Approximately a third of all COVID-19 patients had an intensive care unit (ICU) admission. Presence of cognitive and/or cognitive communication impairment(s) was found in 54.5% of COVID-19 patients (18 of 33), of which 39.4% (13 of 33) did not have a documented pre-existing history of cognitive impairment. The most prevalent cognitive impairments, found in 83.3% (15 of 18) of patients, were in the neuro-cognitive domains of executive and/or perceptual-motor function and memory. 4 of the 10 patients who had an ICU admission demonstrated a cognitive and/or cognitive communication impairment(s). Of the remaining 23 patients who did not have an ICU admission, 14 patients demonstrated a cognitive and/or cognitive-communication impairment.

Conclusion: The presence of cognitive and/or cognitive-communication impairments were found in 54.5% of the sample. With these initial findings and the mounting and evolving literature, this study suggests the need for the administration of a cognitive screen or assessment with patients recovering from COVID-19. However, determining the true prevalence of cognitive and/or cognitive-communication impairments in patients recovering from COVID-19 requires further investigation.

Keywords: COVID-19; Rehabilitation; Impairment; Cognition; Communication

Introduction

Coronavirus disease 2019 (COVID-19), the infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first reported in December 2019. As the COVID-19 pandemic evolved in Canada in early 2020, it was initially thought to be an infectious disease primarily characterized by lung damage and multiple tissue and organ involvement [1]. Over time, this new patient population was being admitted across the healthcare spectrum, including being transferred to rehabilitation hospitals once stabilized in acute care. Given that COVID-19 was caused by a newly discovered coronavirus, little evidence was available on post-acute care and/or rehabilitation recovery. In response to this new patient population, the Professional Practice team at a rehabilitation hospital located in Toronto Ontario, undertook a literature search for COVID-19 care guidelines. The studies located in the literature primarily focused on these patients' physical and respiratory rehabilitation [2-5]. In addition to physical and respiratory manifestations, the clinical team were also observing other impairments (e.g., cognitive and/or cognitive-communication) of patients diagnosed with COVID-19. In this context, a study was undertaken to describe and quantify the cognitive and/or cognitive-communication impairments of COVID-19 patients by performing retrospective chart reviews.

Materials and Methods

Study Setting and Patient Population

The study was undertaken at Bridgepoint Active Healthcare (BAH) campus of Sinai Health in Toronto, Canada. In early Spring 2020, BAH made an organizational decision to cohort all COVID-19 patients onto their Acquired Brain Injury (ABI) inpatient unit from April 2020 to June 2020 to better learn and understand the care needs for this new patient population. During this time, the ABI rehabilitation team, which included occupational therapy (OT), speech language pathology (SLP) and physiotherapy, noticed a trend of cognitive and/or cognitive-communication impairments with COVID-19 patients, which had similarities to the ABI patient population. Specifically, observations in this COVID-19 patient cohort included impairments in attention, perceptual-motor, processing speed, memory, language, and executive function leading to difficulty returning to pre-hospitalization baseline performance (e.g., return to work). The observed impairments were not anticipated as the majority of COVID-19 post-acute care rehabilitation literature focused on patients' physical and respiratory rehabilitation with little to no recommendations for assessment and intervention for cognitive and/or cognitive-communication deficits [2-5].

Study Design

A retrospective description design using chart audits was employed for this study. The study was approved by the Research Ethics Board.

Data Collection and Analysis

A chart audit tool was developed in collaboration with the Health Discipline Professional Practice team. This tool was then used to standardize the collection of specific and relevant data elements to be considered in the study. The chart audit tool extracted COVID-19 patients' demographic information which included age, gender, and primary language. Additional demographic information extracted included reason for acute care hospitalization, COVID-19 symptoms on admission, medical history of cognitive and/or cognitive-communication impairment, admission and discharge dates to acute care and rehabilitation, and cognitive and/or cognitive-communication impairment(s). Patients were also identified as either having a primary or secondary diagnosis of COVID-19. Patients who were admitted to the hospital due to COVID-19 complications were classified as primary diagnosis, whereas patients with other reasons for admission and found to have an incidental COVID-19 infection as secondary diagnosis.

COVID-19 symptoms were collected from the EMR and categorized as common, atypical, and asymptomatic based on symptoms as listed on the Ontario Ministry of Health Covid-19 Reference Document for Symptoms [6]. Common symptoms were characterized as fever, new or worsening cough, dyspnea, and sore throat, difficulty swallowing, new olfactory or taste disorder(s), nausea/vomiting, diarrhea, abdominal pain, runny nose or nasal congestion, and clinical or radiological evidence of pneumonia. Atypical symptoms were characterized as unexplained fatigue/malaise/myalgia, delirium, unexplained or increased number of falls, acute functional decline, and exacerbation of chronic conditions, chills, headaches, croup, conjunctivitis, and unexplained tachycardia, a decrease in blood pressure, unexplained hypoxia, and lethargy.

The Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) categorizes six key domains of cognitive function: language, learning and memory, social cognition, complex attention, executive function and perceptual-motor function [7]. For the purpose of this study, cognitive and/or cognitive communication impairments were grouped into 4 domains: executive and/or perceptual-motor function, memory, attention, and language. This specific grouping was identified based on the assessment tools used by the clinical team which included the Confusion Assessment Method (CAM), Mini-Cog©, Behavioral Assessment of the Dysexecutive Syndrome (BADS), Montreal Cognitive Assessment(MoCA), Motor Free Visual Perceptual Test (MVPT-4), Rivermead Behavioural Memory Test- Third Edition (RBMT3), Rowland Universal Dementia Assessment (RUDAS), Test of Everyday Attention (TEA), Trail Making Test (TMT), Discourse Comprehension Test (DCT)- Listening (Set A) and Reading (Set B) and Functional Assessment of Verbal Reasoning and Executive Strategies (FAVRES).

The chart audit was completed by two auditors following an interrater reliability exercise. Each auditor independently reviewed the same chart using the audit tool, and subsequently convened with the principal investigator to review the audit findings and clarify discrepancies in the data collection. Data collection guidelines were elaborated and documented for discovered discrepancies to ensure increased consistency in the audit. Inclusion criteria were patients ≥ 18 years of age, COVID-19-positive diagnosis, and admission to the COVID-19 cohort ABI inpatient unit. Chart audits were completed on 33 patients that were admitted to the COVID-19 cohort rehabilitation unit from April to June 2020.

Due to the small sample size, descriptive statistics were used to describe the demographics and calculate the frequency of clinical characteristics of the COVID-19 patient population.

Results

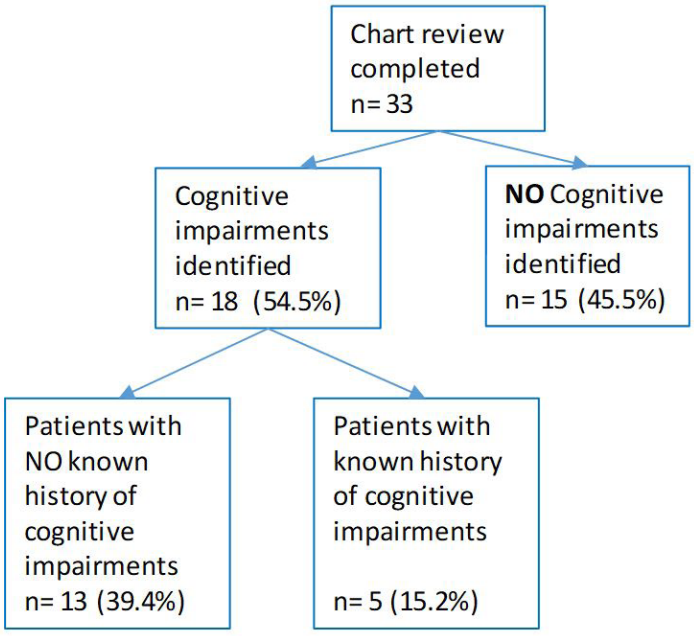

Figure 1: Patients with Cognitive Impairments

A total of 33 patients with COVID-19 were admitted to the COVID-19 unit from April to June 2020, Presence of cognitive and/or cognitive-communication impairment(s) was found in 54.5% of these patients. Of the 54.5% of COVID-19 patients that presented with a cognitive and/or cognitive-communication impairment(s), 39.4% did not have a pre-existing history that included cognitive impairment(s) (Figure 1).

Sample demographics and clinical characteristics

		Mean or N (%)	SD
Gender	Male	19 (57.6%)	
	Female	14 (42.4%)	
Age (years)		71.7	13.8
	Male	73.5	20.9
	Female	69.3	14.7
COVID diagnosis- Primary		25 (75.8%)	
COVID diagnosis- Secondary		8 (24%)	
COVID symptoms		28 (84.8%)	
	Common + Atypical symptoms	15 (45.5%)	
	Common symptoms only	12 (36.4%)	
	Atypical symptoms only	1 (3.0%)	
	Asymptomatic	5 (15.2%)	
Identified cognitive impairments		18 (54.5%)	
	Male	12 (36.4%)	
	Female	6 (18.2%)	
History of cognitive impairments		5 (15.2%)	
Patients with ICU stay		10 (30.3%)	
	Age (years)	57.9	20.7
	NO cognitive impairments identified	6 (18.2%)	
	Identified cognitive impairments	4 (12.1%)	

SD: Standard Deviation

Table 1: Demographics and Clinical Characteristics (N=33)

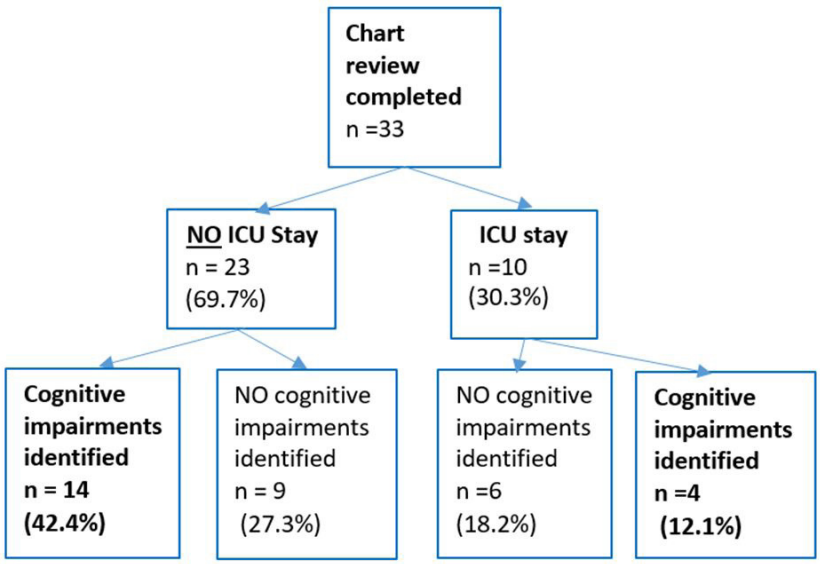

Figure 2: Patients with ICU stays

57.6% of the entire sample was male and on average, 4 years older than the females in the study. The majority of the sample (75.8%) was admitted to acute care because of a COVID-19 infection (i.e., COVID-19 as the primary admitting diagnosis) with most patients (84.8%) presenting with COVID-19 symptoms. Almost half of the COVID-19 patients presented with both COVID-19 common and atypical symptoms, 5 COVID-19 patients were asymptomatic, and one COVID-19 patient presented with only atypical symptoms. Approximately a third of all COVID-19 patients had an intensive care unit (ICU) stay. Of the 10 COVID-19 patients who required ICU hospitalization, 4 developed cognitive and/or cognitive-communication impairment(s) that were not present at baseline. Patients with an ICU stay were also much younger in age than the average COVID-19 patient in the study (57.9 yrs. vs 71.7 yrs.). See Table 1 for demographic and clinical characteristics and Figure 2 for further breakdown of ICU stay.

Cognitive functioning

The most prevalent cognitive impairments, found in 83.3% (15 of 18) of patients, were in the domains of executive and/or perceptual-motor function and memory. 14 out of 18 patients presenting with cognitive impairments in one or more of the identified cognitive domains had no ICU stay. See Table 2. None of the 33 patients of this study presented with a positive CAM score to indicate the presence of delirium.

	Identified Impaired Cognitive Domains				
	Patients with cognitive impairments	**Patients with NO known history of cognitive impairments**	**Patients with known history of cognitive impairments**	**Patients with NO ICU Stay**	**Patients with ICU Stay**
Cognitive Domains	n = 18	n = 13	n = 5	n= 14	n= 4
Executive and/or Perceptual-Motor Function	15	10	5	13	2
Memory	15	10	5	12	3
Attention	7	6	1	4	3
Language	5	5	0	3	2

Table 2: Cognitive Domains

Discussion

The objective of this study was to report the characteristics of COVID-19 patients admitted to the COVID-19 unit from April to June 2020. In the current study population, 57.6% were male and 66.7% of the male sample population presented with cognitive and/or cognitive communication impairments (12 of 18). This is consistent with other studies that reported higher percentage of males in their COVID-19 study sample [8,9] as well as a possible association with more severe form of infection [10-12]. Of interest, in the current study, male patients were also older in age as compared to the female patients (average age 73.5 vs 69.3 years old). The males in this study may have experienced more cognitive symptoms not only due to their gender, but also this difference in age, given that literature has shown that age is closely correlated with a more severe disease course [12].

Cognitive impairments are known complications of critical illness with acute respiratory distress syndrome (ARDS) associated with neurological impairments [13-16]. Hypoxia, prolonged mechanical ventilation, hypercoagulability, delirium are some critical illness factors that are associated with cognitive sequelae [16]. Individuals who have survived ARDS have shown to have a high prevalence of cognitive difficulties and those with pre-existing cognitive deficits may now have worse decline in cognitive functioning secondary to the disease [15]. COVID-19 complications leading to critical illness may be one reason that some patients in this study developed cognitive and/or cognitive-communication impairments. For example, Almeria et al. found 34.3% of their patients (12 of 35) had cognitive complaints after COVID-19 infection, and patients requiring oxygen therapy had lower scores in memory, attention, and executive function when compared to asymptomatic patients [11]. This study explored delirium as a char-

acteristic associated with cognitive impairment; however, none of the patients in the sample study were found to have a positive CAM test which suggests that delirium was not a factor that could potentially influence the study findings.

There is now emerging evidence that cognitive impairments can be a common complication of COVID-19 [8,9,13,15]. Ritchie et al. found that the hippocampus appeared to be particularly vulnerable to coronavirus infections leading to an increased probability of post infection memory impairments [17]. The findings of the current study appear to be supportive of this, as memory was affected in 83.3% of the cohort of patients with cognitive impairments. In contrast to Pinna at al. who found 60% (30 of 50) with altered mental status and 24% (12 of 50) with short term memory loss [9], this study found 54.5% (18 of 33) with cognitive impairments and 45.5% (15 of 33) with impairments in the neurocognitive domain of memory. Other studies also indicated that impaired attention was a significant finding [8,14], however this current study only demonstrated that the attention domain was impacted in 7 of 18 patients with cognitive impairments (38.9%).

In this current study, 5 patients were identified as having a cognitive and/or cognitive communication impairment as well as a known pre-existing history of cognitive impairment(s). It is important to note that without baseline/pre-COVID cognitive testing data, it is unclear if COVID-19 further impacted the cognitive and/or cognitive-communication function of these patients.

Mao et al. reported that patients with COVID-19 who presented with a more severe disease course were likely to develop neurological symptoms, especially acute cerebrovascular disease, when compared to those with mild/moderate disease [18]. Khatoonabadi et al. reported that the areas of most difficulty for post ICU COVID-19 patients appears to be in the areas of memory, attention, visuospatial, psychomotor, and executive function deficits [15]. An important difference between these studies and this current study was that all 4 cognitive domains were noted to be an area of difficulty for patients with no ICU stay, which could suggest that the presence of cognitive and/or cognitive communication impairment with COVID-19 is not dependent on ICU admission. From the 33 patients whose charts were reviewed, 69.7% (23 of 33) did not have an ICU stay. And of the 23 patients with no ICU stay, 14 were identified as having cognitive and/or cognitive-communication impairments. In contrast, only 4 of the 10 patients who had an ICU stay presented with such impairments.

Implications for Practice

This current study points to the utility of using screening tools such as the MoCA and Cognitive Linguistic Quick Test (CLQT) assessment tools as a quick initial screen to identify impairments in all 4 cognitive domains and is congruent with existing literature [15,16]. Collectively, the use of these screening tools to assess patients in acute and/or inpatient rehabilitation and the early detection of cognitive concerns would allow for treatment of cognitive and/or cognitive-communication impairments to be included as an essential rehabilitation component to enhance quality of life of patients recovering from COVID-19. This study findings have been used to inform BAH's OT and SLP practice guidelines in the care of COVID-19 patients. Specifically, BAH COVID-19 rehabilitation practice guidelines were updated for assessments of patients recovering from COVID-19 to include a cognitive screen using MoCA or RUDAS, and if positive, a cognitive-communication screen using CLQT.

Limitations

Limitations of this study include its retrospective approach, as well as the limited number of COVID-19 patients admitted for rehabilitation during a three-month time span. A total of 33 patients were studied, including patients with COVID-19 as a secondary diagnosis. Additionally, presence of cognitive impairment was determined by various assessments and administered by numerous clinicians (i.e., nurse, OT, SLP). Patients with a past medical history of cognitive and/or cognitive-communication impairments were also included in the review, and it was difficult to determine if COVID-19 had further impacted their pre-existing impairments.

Conclusion and Future Directions

The presence of cognitive and/or cognitive-communication impairments were found in 54.5% of the sample with executive and perceptual-motor function, and memory being the most affected neurocognitive domains (83.3% respectively). These initial findings and the mounting and evolving literature are suggesting the need for administration of a cognitive screen or assessment with patients recovering from COVID-19. More than a year later, our understanding of this disease is still incomplete, particularly its long-term sequelae of infection. Further investigation and study are needed to determine the true prevalence of cognitive and/or cognitive-communication impairments in patients recovering from COVID-19 and their rehabilitation needs. Using evolving evidence to update OT and SLP practice guidelines may serve as a blueprint for other post-acute organizations, as well as in the development of evidence based and best practice guidelines for this new patient population.

Declarations

Ethics approval: Institutional and research ethics approval was obtained at Mount Sinai Hospital (Sinai Health System) Research Ethics Board (20-0258-C).

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Authors' contributions: All authors helped analyze and interpret the data, critically revised and approved the final manuscript.

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Declaration of interest: The authors declare no competing interests.

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